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Extraction of Pectin from Mango Peel and Application of Pectin

P.M. Patel*

SVMIT College campus, Old N.H. No.-8, Bharuch – 392 001, Gujarat, India.

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ABSTRACT

The study was carried out to optimum condition for extraction and precipitation of pectin from mango peels were investigated change in pH. Maximum pectin yield was precipitated 21.70% due to acidity of the solution played a significant role in the extraction of pH 2.0 at 100 °C temperature for 60 minutes. It was precipitate from the extract by adding 95 % ethanol. Better extraction of pectin with sulphuric acid might be due to the presence of sulphate ions in soaking solution. Pectin is extensively utilized by food processors especially for the conversion of low grade fruits into good quality products. Pectin has many applications as functional ingredient in nutrition, cosmetics and pharmacy. The novel pectin usages like; biodegradable, water-soluble films, bulking agents, coating agents, chelators, emulsifiers and viscosity modifiers.

1. Introduction

Pectin was extraction from several sources such as mango peel, banana peel, papaya peel, citrus peel, lemon peel, grape peel, sugar beets, apple pomace and sunflower heads. The amount, structure and chemical composition of the pectin differs from plant to plant, within a plant over time and in different parts of a single plant [1].

Mango is one of the world's major tropical fruits. Total production was worldwide being around 25 million metric tons a year. Mango is the important fruit crop of our country. It occupies 1,50,000 ha out of 3, 90, 000 ha area under all fruit crops. Mango peels which constitute 20 - 25% of the processing waste are available in large quantities and it could be very useful source of raw material for the extraction of pectin.

Mango peel is good source of pectin about 10 – 15% [2]. However, there is scarce information in literature about the extraction of pectin from mango peels. Therefore, attempts were made to optimize conditions for the maximum recovery of pectin from mango peels.

Chemically pectin consists of long unbranched chains of polygalacturonic acid with carboxylic group partially esterified with methyl alcohol. Extracted pectin can be categorized into two major categories depending on the percentage of galacturonic acid residues that are esterified with methanol. A degree of methoxylation (DM) greater than 50% is considered high methoxyl pectin and DM below 50% is considered low methoxyl pectin [3].

2. Experimental Methods

2.1 Material

All chemicals used for extraction process were analytical grade. Fresh mango peels were collected from some selected hotels, juice processing houses and restaurants.

2.1.1 Methods of Material Preparation

The fresh fruit peels were segregated according to their type, cut into pieces for easy drying and washed with water three times. Sample drying was carried out in oven at 60 °C to reduce moisture content to 5–6%. The dried peel was milled in sieve size of 80 meshes and packed in airtight, moisture-proof bag at room temperature and ready to the extraction process.

2.2 Extraction of Pectin from Mango Peels

The objective of this part of work, the study of the effect of pH of the medium on the yield of pectin extracted. Ground and defatted mango peels were mixed well with water of different pH (1.5, 2.0, 2.5, 3.0, 3.5), keeping substrate to water ratio 1:40 (w/v). The desired pH of the mixture was adjusted with 0.1 N sulphuric acid on pH meter. Thereafter, the mixture was heated at 100 °C temperature for 60 minutes with frequent stirring. The contents were filtered through cheese cloth and filtrate was precipitated with 95% ethanol. The obtained pectin was dried in a vacuum oven at 40 °C. Dried pectin was obtained. The observation is given in Table 1.

2.3 Percentage Yield of Pectin

Yield (%) of pectin is based on the gram of peel sample taken, and is calculated by formula as given below;

$$Y_{pec} (\%) = P / P_i \times 100$$

where, Y_{pec} (%) is the extracted pectin yield in percent (%). P is the amount of dry pectin in g and P_i is the initial amount of mango peel in gram.

3. Results and Discussion

Different pH of the solution played a significant role in the extraction of pectin. At pH 1.5, 2.0, 2.5, 3.0 and 3.5 pectin yield was 17.11, 21.70, 16.90, 14.60 and 13.00 respectively, when mango peels powder was suspended at 100 °C temperature for 60 minutes (Table 1). Acidity of the solution played a significant role in the extraction of pectin. Better extraction of pectin with sulphuric acid might be due to the presence of sulphate ions in soaking solution.

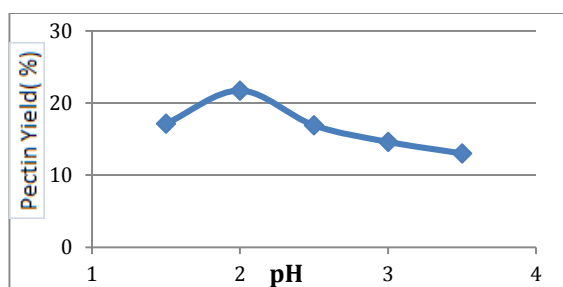
Result of statistical analysis showed that the pectin yield increased when the pH was increased from 1.5 to 2.0. However, increasing further the pH 2.5 to 3.5 did not further increased in the yield primarily due to the breakdown of pectic substance at higher pH. Pectin yield at higher temperature could be attributed due to breakdown of pectin molecules as already observed by Rehman, et al and Chang, et al [4-11]. This observation implied that pH 2.0 is the best pH for pectin extraction from pulverized dried mango peel. It can be seen graph plotted between pectin yields (%) obtained for various values of pH of medium as show in Fig. 1.

*Corresponding Author

Email Address: pmpatelphd@gmail.com (P.M. Patel)

Table 1 Experimental observation of yield of pectin at different pH

Solution of pH	pH = 1.5	pH = 2.0	pH = 2.5	pH = 3.0	pH = 3.5
Volume taken for extraction (mL)	200	200	200	200	200
Amount of peel sample added (g)	5	5	5	5	5
Extraction temperature (°C)	100	100	100	100	100
Extraction time (min)	60	60	60	60	60
Volume of Ethanol added (mL)	40	40	40	40	40
Centrifuge (rpm)	8000	8000	8000	8000	8000
Centrifuge time (min)	10	10	10	10	10
Weight of dried pectin obtained (g)	0.8555	1.085	0.845	0.73	0.65
Yield of pectin obtained (%)	17.11	21.70	16.90	14.60	13.00
Colour of pectin yield	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown
Solubility of pectin in cold water	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble

**Fig. 1** Pectin Yield(%) obtained for various values of pH

4. Conclusion

In the study, maximum yield was precipitate 21.70% due to acidity of the solution played a significant role in the extraction of pH 2.0 at 100 °C

temperature for 60 minutes. Ethanol can be successfully used as precipitating agent for maximum recovery of pectin from the extracted filtrate. Better extraction of pectin with sulphuric acid might be due to the presence of sulphate ions in soaking solution. Pharmaceutical grade pectin and maximum yield of pectin was indicating that it is of superior quality.

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